

# THE ANNALS

AND

## MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

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"..... per litora spargite muscum,  
Naiades, et circum vitreos considite fontes:  
Pollice virgineo teneros hic carpite flores:  
Floribus et pictum, divæ, replete canistrum.  
At vos, o Nymphæ Craterides, ite sub undas;  
Ite, recurvato variata corallia trunco  
Vellite muscosis e rupibus, et mihi conchas  
Ferte, Deæ pelagi, et pingui conchylia succo."  
*N. Parthenii Giannettasi, Ecl. 1.*

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I.—*Some new Parasitic Copepods found on Fish at Bombay.*  
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[Plates I.-VII.]

THE continuation of the investigation of the parasitic Copepoda of fish which I commenced at Plymouth (see *Ann. & Mag. Nat. Hist.*, July 1896, and 'Journal of the Marine Biological Society,' February 1896) was much favoured by my being stationed for a lengthy period at Bombay: this was all the more interesting as it practically opened up an almost unknown field, for, beyond the valuable works of Dr. Heller and Krøyer and some stray notes, there has hardly been anything written about these minute animals living on fish found in Eastern waters; and as apparently many individual fish, or, at least, genera of them, have organisms peculiar to themselves preying on them, it is not surprising that a comparatively large number of new species should have been obtained.

As in England, it was noticed that those specimens which most frequently provided parasites were not in any way in bad condition, or showed only in exceptional cases evidence of their presence being harmful to the host. These parasites

may be roughly divided into two classes—the blood-suckers and the mucus-eaters. Of the former are here described species of *Lernanthropus*, *Peroderma*, and *Lernæonema*; the last, as exemplified by *L. polynemi*, must indeed cause a great amount of irritation and trouble to its host, being found in such numbers on a single fish and burrowing so deeply into the flesh: the second group includes the “Caligidæ,” with *Bomolochus*, *Brachiella*, *Chondracanthus*, &c. The species of *Caligus* were seen very actively moving about in the gill-cavity or on the surface of the fish, rarely causing any trouble; the latter two fixed, but not deeply, the long neck of *Brachiella* and *Anchorella* being seen twisting about so as to apply the head to different spots as wanted. The manner in which the free-swimming embryos find their respective hosts is not known and is curious to think of. On the tail of one *Caranx Rottleri* I found some half-dozen specimens of an immature *Caligus* attached by the frontal filament.

I have as far as possible followed Gerstaecker's system; but there is a great deal of discrepancy between the various authors, and in some the plates and descriptions are very meagre. The character of the antennæ, which would seem to be a feature on which “generic” classification might be based or assisted, is in *Lernanthropus* quite lost, for Heller represents all his specimens with two-jointed anterior antennæ (if correctly figured and described), whereas Krøyer's and my specimens invariably have six- or seven-jointed antennæ, which is, I believe, the normal form. The genus *Bomolochus* might well be divided into two subgenera—first, those with elongated rostrum and anterior antennæ provided with long bristles, as *B. megaceros*, Heller, and *B. tricerus*, sp. n.; and second, those with short rostrum and anterior antennæ unprovided with bristles, as in *B. gracilis*, Heller, *B. tetradonis*, &c.

I have been forced to create a new genus—*Helleria*—for a species of the family Dichelesthina taken from the gills of *Cybbium guttatum*, which, though closely connected with Heller's *Pseudocygnus*, yet is, I think, distinct.

Finally, I may say that for preservative purposes, though a solution of formol keeps the soft-bodied specimens well, yet it has a tendency to blacken the chitinous-coated ones, as *Caligus* &c.

#### Ergasilidæ.

*Bomolochus tricerus*, sp. n. (Pl. I. fig. 1.)

Many specimens of this species were taken at Bombay from

the gill-cavities of *Stromateus cinereus* (white pomfret), both male and female: it differs essentially from *B. megaceros* of Heller, which he found on *Stromateus niger*, on which fish I frequently also found that species; it, however, bears outwardly a nearer resemblance to *B. scomberesoces* of Kröyer, but differs from the latter in detail, the three setaceous horns being much more pronounced, the last joint of the fifth peræopoda having four instead of three short setæ, &c. (see Pl. I. fig. 1).

*Female*.—Body elongate; cephalothorax 5-partite, first segment much broader than long. Frontal border deeply concave in the middle line. *Anterior antennæ* elongate, basal joint arcuate; at the inner end there is placed a trilobate process, the root of which connects with a curious circular disk, the anterior margin of which is fringed with fine hairs; from each lobe of this frontal appendage springs a strong simple sharp bristle, the inner being slightly the longest; there are also three more simple bristles from the anterior frontal border, the one immediately outside the frontal process being long and very slender, the other two much shorter. The whole anterior border is fringed with about twelve finely plumose setæ, two being inside the frontal process, three between first and second bristles, and two between second and third; there are four elongated free joints provided with fine hairs at the angles, the last with seven at the extremity. *Posterior antennæ* biarticulate, second joints minutely granular, terminating in a thickened crenulate pointed process, and four fine simple setæ, the inner border finely dentate, the teeth becoming much coarser near the end and elevated. *Hamulus* placed laterally; it is large and two-jointed, the second joint made up of an elongated hook with a ciliated appendage of equal length. *Rostrum* very long and pointed. *First peræopods* two-branched, outer with one joint, the inner with two, all provided with plumose hairs; second, third, and fourth two-branched, each with three joints, the outer branches carrying on the outer side short spur-like bristles, the others plumose; fifth single-branched, the last joint being provided with three short bristles terminally and one on the outer border. *Genital segment* square. *Abdomen* of four joints, decreasing in size downwards, the last bearing the *caudal plates*, which are longer than broad, giving off one very strong central bristle and two short fine lateral ones; also a minute hair is seen on the outer border.

*Egg-sacs* large, dilated.

Male smaller, but differing slightly from the female.

*Bomolochus tetradonis*, sp. n. (Pl. I. fig. 2.)

These specimens were found abundantly in the gill-cavities of *Tetrodon oblongus* at Bombay; both sexes were generally present together in the same fish. They resemble somewhat *B. gracilis* of Heller, which he found on the hammer-headed shark at Java, but differ in detail. By obtaining a large number of specimens it was found to vary very much in form, proportionally of length to breadth, even in mature females, as shown in Pl. I. fig. 2; so that the mere external conformation is of comparatively little assistance in differentiation of the species (in mounted specimens the frontal border always folds backwards and renders examination difficult).

*Female*.—Cephalothorax pyriform or elongated, divided into five distinct segments, arched dorsally. First segment shorter than long, second to fifth becoming progressively more so. *Anterior antennæ* arcuate, elongate, bearing on the front edge about sixteen short setæ with rounded bases; three free club-shaped joints, the last being provided with many short bristles. *Posterior antennæ* two-jointed, terminating in five (?) short setæ. *Hamulus* placed far forwards and to the side, in the shape of a very strong, short, thick, slightly curved spur.

Mouth-organs are placed between a well-marked upper and lower lip, there being no sharp-pointed rostrum as in the last species; into this space project three pair of appendages, the most anterior, the *mandible*, having three joints, the last consisting of a long curved pointed joint, with its convex border finely crenulate and an accessory palp; the second being the *first maxilliped*, also three-jointed, the first joint being long and cylindrical, the second short, and the third in the form of a strong slightly curved claw; the third being the *second maxilliped*, larger, with a thicker basal joint, terminal joints simple, with finely dentate concave margin.

First four *peræopods* two-branched, second to fourth each with three joints, provided with plumose hairs on the inner border and with more or less elongated simple bristles on the outer, that of the second joint of the inner branch of the second pair being very long and strong.

Fifth *peræopod* three-jointed, the last joint being provided with three short bristles only.

*Genital segment* short and broad. *Abdomen* consisting of four joints progressively decreasing in size, the last terminating in two caudal plates nearly three times as long as broad, carrying two long terminal bristles and two short lateral ones.

## Family Caligidæ.

## Genus CALIGUS, Mill.

*Caligus parvus*, sp. n. (Pl. II. figs. 1, 2.)

This species was found very frequently on the inner surface of the operculum and also free on the surface of *Tetrodon oblongus* from Bombay Harbour; they were often seen actively moving about, and were of a pinkish colour, both sexes being equally common. I have been unable to place this species with any known ones, though it bears a resemblance to *C. abbreviatus*, Kr., in form, but differs in detail (Pl. II. fig. 1).

In the female the cephalothorax is almost circular, slightly broader than long, equalling in length the remainder of the whole; it narrows anteriorly, where it unites with the frontal plate, being evenly rounded at the posterior angles. The frontal border is narrow, concave in the centre, and bears small lunulæ in the outer third. The first joint of the *anterior antennæ* is short and thick, with about twenty short plumose setæ on the front border; the second joint is shorter and carries fine hairs at the end. *Posterior antennæ* are placed a short distance behind the frontal plate, are three-jointed and of moderate size. *Hamulus subsidiarius anterior* is in the shape of a short hook with a dilated base. *First maxilliped* is very slender, ending in two small claws, the outer being the longer. *Second maxilliped* very large and characteristic, the end claw being extremely strong and thick, the basal joint having a large process to which the other is opposable. *Furcula* is small, with very short blunt branches, spreading but slightly.

The first of the swimming-feet (peræopoda) has a short basal joint, elongated second, and the third terminating in three short bristles, with four elongate plumose setæ on the posterior border, the one at the angle being the longest.

*Genital segment* is square, with rounded angles. The abdomen is very short, carrying extremely short caudal plates; these are as broad as long, and are provided with three long plumose setæ terminally and two minute short hairs on the outer border.

Length 3·4 millim.

*Male*.—This has the after portion of the body more elongated, the posterior angles of the genital segment produced, carrying two fine hairs, the caudal plates are longer; but the most characteristic change is in the great development of the accessory hook, probably for better holding the female.

Length 2·3 millim.



*Caligus cybii*, sp. n. (Pl. II. fig. 3.)

This species was found in the gill-cavity of *Cybiium lineolatum* at Bombay. Only one specimen, a female.

Cephalothorax longer than broad, contracted in front. Frontal plates bearing small lunulæ. *Anterior antennæ* with basal joint short and stout, terminal club-shape. *Posterior antennæ* with strong recurved hook. *Hamulus* short, with broad base. Palp at the base of first maxilliped long and thin. Second maxilliped provided with a narrow, slightly curved claw, nearly as long as basal joint. *Furcula* rather large, with slightly curved, simple, divergent branches. *First peræopod* having the extremity of the terminal joint provided with three rather strong short bristles, the anterior being the shortest; at the angle a fine plumose hair, with three rather long plumose ones on posterior border. Second peræopods carry on the outer border of the joint's outer branch two slightly curved chitinous hooks; the hamulus posterior on the third peræopod being shorter and thicker. Fourth peræopod has the terminal joint provided with three long, fine, curved, simple setæ, with a minute spur at the angle, the penultimate and postpenultimate portions also bearing simple curved setæ, the last four are in close proximity. *Genital segment* almost oblong, with slightly lobed and rounded posterior angles. Abdomen half length of cephalothorax, nearly four times as long as broad, indistinctly two-jointed, the last joint being as long as broad. Caudal plates equalling in length last joint of abdomen; they carry three short plumose bristles at the extremity and a shorter one on the outer border.

Total length 5 millim.

This species differs from *C. pelamydis*, Kr., in its longer cephalothorax, shorter abdomen, and structure of the furcula and fourth peræopods.

*Caligus hirsutus*, sp. n. (Pl. III. figs. 1, 2.)

This species was very commonly found in the gill-cavity of *Polynemus tetradactylus* at Bombay. It was extraordinary on account of the peculiar dilated condition of the abdominal segment, which I at first took to be an abnormality; but as it was apparently universally present in the females, it must be taken as the normal condition. Also the rosette-like bunches of hairs at the base of each of the thickened setæ of the fourth peræopods were quite unique; though very distinct in the fresh specimens, these hairs were exceedingly difficult to detect in mounted ones, except when in glycerine (Pl. III. fig. 1).

*Female*.—Cephalothorax oval, nearly twice as long as broad, about one third of the total length. Frontal plate slightly concave in front; lunulæ shallow, but of considerable diameter. *Anterior antennæ* having the basal joint slightly longer than the width of the lunula; setæ markedly plumose, the outer being strongest; second joint club-shape, about seven short bristles at the end. *Posterior antennæ* in the form of a long, much curved hook; spur at the base sharp. *Hamulus* very small and short. Palp at the base of first maxilliped long and sharp. *Second maxilliped* with the terminal joint in the shape of a long recurved simple claw. *Furcula* small, with straight-edged but slightly spreading branches. There are three very short simple setæ on the last joint of first peræopod, with only three longer plumose ones on posterior border; the second joint has the edge fringed with fine hairs. Hamulus posterior on third peræopod small and curved. Fourth peræopod: first joint strong, the terminal joint consists of three parts welded together, forming a blunted extremity, the last having on its inner border three short, thickened, slightly curved simple setæ, the first with its inner border crenate, the next joint bears a fourth close to these, and at the base of each is a rosette-like bunch of fine hairs of a dark colour.

*Genital segment* is much wider posteriorly and is deeply lobed. The abdomen is as long as the cephalothorax, having this dilated to an equal width with the last joint, being of a dull semitransparent appearance. Caudal plates longer than broad, bearing three terminal plumose bristles, the centre one being much the longest; there is also a shorter one on the outer border.

Length 7 millim.

*Male* has an oval genital segment, the abdomen divided into a short and following elongated portion, with caudal plates much longer than in female (Pl. III. fig. 2).

*Caligus Phipsoni*, sp. n. (Pl. III. figs. 3, 4.)

This species was found free on the inner surface of the gills of *Cybius guttatum* at Bombay; only a few specimens of both male and female were taken. In general form it resembles *C. irritans*, Heller, but differs in having the cephalothorax rather broader, the furcula larger, the abdomen single-jointed, and in the arrangement of the bristles on the caudal plates (Pl. III. fig. 3).

*Female*.—Cephalothorax longer than broad, slightly narrowed anteriorly, rounded at the angles posteriorly, slightly

lobed. Frontal border slightly concave. Lunulæ very large, the whole thickness of the plate. *Anterior antennæ* having the basal joints short and thick, with about fifteen plumose setæ on front border, with simple bristles near outer end; second joint dilated at end, with seven fine bristles. *First maxilliped* very slender; no setæ seen on second joint, as in *C. irritans*. *Second maxilliped* having the end claw strong but short, provided with a short bristle on concave border one third from point. *Furcula* with narrow, pointed, slightly spreading branches, from a wide base. The terminal joint of the first peræopod has three short bristles at the end, decreasing in length from first to third; at the angle there is a fine plumose hair and on under border three longer similar ones with thickened bases. Fourth peræopods are long, the terminal joint provided with five moderately long, curved, simple claws, the last three being close together. *Genital segment* oblong, with the posterior angles slightly produced, three fourths as long as the cephalothorax. Abdomen short, half as long as the last segment, single-jointed, slightly constricted anteriorly. Caudal plates rather longer than broad, terminating in three moderately long plumose setæ, and having a shorter one on the outer border.

Length 5 millim.

The *male* has the cephalothorax much more elongated, the genital segment is more pyriform, and the abdomen longer; the hamulus anterior is also very long and sickle-shaped (Pl. III. fig. 4).

Length 3 millim.

*Caligus longicaudus*, sp. n. (Pl. IV. figs. 1, 2.)

This species was found in small numbers of either sex in the gill-cavities of two fish in Bombay Harbour—*Trichiurus haumela* and *Chirocentrus dorab*. It differs from *C. productus*, Dana, by the short genital segment, the absence of the deep notch on the frontal plate, by its less sharply pointed furcula, and in the detail of the first peræopods &c.; from *C. trichiura*, Kr., by the longer cephalothorax, larger and deeper lunulæ, and different shape of the furcula.

*Female* (Pl. IV. fig. 1).—Cephalothorax almost a perfect oval, with the posterior angles rounded, less than half the total length. Frontal plate with slightly convex anterior border; lunules large, extending the whole depth of the plate. *Anterior antennæ* having the basal joint short, not quite so long as the diameter of the lunula; it is provided on its anterior border with eight rather stout, short, plumose



setæ, the ones nearest the lunulæ being the largest; at the end are three strong bristles, equalling in length the second joint, which terminates in three or four long bristles and several short ones. *Posterior antennæ* three-jointed, the last in the form of a strong hook, the basal joint carrying a sharp pointed process. *Hamulus* very small and blunt. *First maxilliped* having a long pointed palp at the base; terminating in a bifid claw at the end, not very long. *Second maxilliped* with a stout basal joint, having a small spur at the base; terminal hook shorter than the basal joint. *Furcula* with a wide elongated base, giving off from a narrow neck two flattened, blunt, almost straight, simple branches. First peræopods three-jointed; there is a small short spur at the outer end of the anterior border of the second joint; the third is short and carries three short terminal bristles, the posterior border being provided with three long finely plumose setæ. The second peræopod has the terminal joint of the outer branch furnished with eight long plumose setæ, the anterior border with three short simple bristles, the first joint bearing two long chitinous spines. Third peræopod shows a very small straight hamulus posterior. Fourth peræopod is strong, terminating with four long, slightly curved claws placed close together, and a fifth about halfway up the inner border. *Genital segment* broader than long, posterior angle lobed, bearing a rudimentary fifth limb, furnished with three plumose hairs. Abdomen indistinctly two-jointed, almost as long as the cephalothorax. Caudal plate longer than broad, with three long terminal plumose setæ and two shorter ones on the outer side, also one on the inner border.

The *male* (Pl. IV. fig. 2) has a more elongated genital segment, a more distinctly two-jointed abdomen, the second maxilliped is very strong, the claw being provided with a small bristle near its lower third; and on its basal joint, front border, are one single and three bifid tubercles.

*Caligus (Sciænophilus, Van Ben.) Benedeni*, sp. n.  
(Pl. IV. fig. 3.)

This species I have only taken once—a female, from *Sciænia diacanthus*, at Bombay.

*Cephalothorax* one fifth of the whole length and much less broad than the genital segment; it is almost circular in shape, bearing fairly strong frontal lobes with a straight border; the lunulæ are very small. Basal joints of *anterior antennæ* provided along the anterior border with about twelve very fine plumose setæ, the second having at its thickened end two

long and several short hairs, also one or two on the posterior border.

*Posterior antennæ* small, acutely bent. First maxilliped very slender, second with very strong simple end-claw, which is slightly granular on high magnification.

*First pereopod* with three long end-bristles and three moderately long plumose setæ on the posterior border.

*Fourth pereopod* having four long, slightly curved, terminal claws close together and a fifth halfway down the inferior border.

*Genital segment* rather longer than broad, much larger than cephalothorax. Abdomen long, thick, single-jointed, constricted at the anterior end. Caudal plates longer than broad, curved inwards, with three long terminal setæ and a shorter one on the outer side (Pl. IV. fig. 3).

Length 6 millim.

This subgenus seems to be found most regularly on the "Scianidæ," the comparative small size of the cephalothorax, small lunulæ, and extremely large maxillipeds being very distinctive.

#### Family Dichelesthina.

##### Genus HELLERIA, nov.

Body elongate, without dorsal plates; head rounded. Anterior antennæ setaceous, six- or seven-jointed. Posterior antennæ in shape of strong hooks. First maxillipeds small, second in form of large claws. Thorax three-jointed, each provided with a soft lateral process. Three pair of rudimentary limbs only present—first biramose, second uniramose, third stump-like.

*Genital segment* about three times the length of head and thorax. Caudal plates of moderate size, lancinate.

*Male*.—Smaller, but differing slightly from female.

This genus should be placed between *Clavella* of Oken and *Pseudocycnus* of Heller, being most nearly related to the latter, but having these generic differences:—(1) many-jointed anterior antennæ; (2) three-jointed thorax, bearing only three pair of limbs; and (3) enormously enlarged second maxillipeds.

*Helleria armata*, sp. n. (Pl. V. figs. 1, 2.)

A number of specimens of this species were found in the gills of a *Cybbium guttatum* at Bombay, both sexes, colour dull opaque white.

Length about 8 millim.

*Female* (Pl. V. fig. 1).—Head almost round. *Anterior*

*antennæ* six- or seven-jointed, first joint broad, second elongate, with fine hairs at the base and a lobe-like process from the front border equalling in length the segment, third joint with three fine hairs, fourth with two, fifth and sixth with two, and terminal joint with seven bristles. *Posterior antennæ* three-jointed, last in the form of a strong hook, with a well-marked tooth on the concave border near the centre. *Rostrum* in the form of a short strong chitinous tube. *Maxillary palp* three-jointed, the last joint being sharp and curved. *First maxilliped* three-jointed, the basal joint being thick and muscular, the second cylindrical, the furthest end of the inner border being finely dentate; last joint short, sharp, curved, and dentate on concave border. *Second maxilliped* two-jointed, the basal joint being of very great size and muscular, its lower margin undulate and fringed with bunches of fine hairs; second joint in form of a strong curved claw, the internal border being armed with a strong tooth. *Thorax* three-partite, the first segment having a soft lateral rounded appendage on either side, those of the next two segments being longer; under the first is seen a small plate with edge finely ciliated, giving off the rudimentary first two-branched peræopod, the outer an oval single-jointed limb terminating in one minute hook and two short hairs; the inner branch is shorter and carries three minute hairs. Under the second appendage is another plate carrying a single-jointed limb, terminating in a small hook, and the inner edge being provided with many fine hairs. Behind the third appendage, springing from the anterior portion of the genital segment, is a minute stump, from the apex of which is a single bristle.

*Genital segment* constricted in front, twice as long as head and thorax, indistinctly lobed at the posterior extremity. Two elongate foliaceous caudal plates. Egg-sacs long, thin.

*Male* (Pl. V. fig. 2).—Body shorter, head more oval. *Posterior antennæ* longer than in the female; no thoracic appendages. Maxillipeds are also less robust, but very long and powerful. The rostrum is longer, and on either side of the lower lip is a sharp, slightly curved, very long, articulate movable process directed directly backwards, equalling about half the length of the head.

Both terminal joints of first peræopods have comparatively strong claws—in fact, these paired limbs are more developed in the male. Genital segment elongate, tapering posteriorly, where a rounded abdominal portion is distinctly marked off, carrying two caudal foliate appendages, the extremity being fringed with fine hairs.

## Genus LERNANTHROPUS, Nordm.

*Lernanthropus trifolius*, sp. n. (Pl. VII. fig. 3.)

This species was taken from the gills of *Polynemus tetradactylus* in Bombay, but was rare; four were taken from one fish, two on either side, all being mature females. When taken from the body they were distended with sanguineous fluid (Pl. VII. fig. 3).

*Female*.—Head oblong, with rounded angles, strongly notched in front, folding inwards on under surface. Dorsal scutes bipartite, anterior segment pyriform, constricted at the neck. Posterior scute much dilated and rounded, from under which project the fourth pair of foliaceous peræopods. *Anterior antennæ* six-jointed, setiferous; posterior two-jointed, terminating in a strong simple claw. Feet of third pair in the form of strong lamellar plates directed outwards, curved, folding on themselves like a leaf, projecting slightly beyond first dorsal scute. Fourth pair in the form of elongate lamellar processes, two of which project considerably beyond the posterior margin of the second scute; the third is more acuminate, shorter, and placed beneath the other two. Abdominal segment longer than broad. Caudal plates of moderate size, simple, lancinate.

Length 8 millim.

The six-jointed anterior antennæ, elongated plates of fourth peræopods, which consist of three processes, and short genital segment differentiate this species.

## Family Lernæoidea.

## Genus LERNÆONEMA, M.-Edw.

*Lernæonema polynemi*, sp. n. (Pl. VII. fig. 1.)

This species was found very frequently, of all sizes, one or more being almost always present on well-grown specimens of *Polynemus tetradactylus* taken in Bombay; and they must be a great pest to this fish. Often as many as a dozen were found on one, the head and neck deeply buried into the flesh; the body was full of blood, and yet the host appeared always well nourished. The favourite sites were:—(1) at the base of the caudal (I have traced the neck in on one side, and passing between the vertebræ found the head near the surface on the other); (2) behind the dorsal fin; (3) just behind and

above the pectoral. Near the point of insertion there was often an area of extravasated blood from irritation.

This species resembles most *L. encrassicola* of Baird, but the sharp cephalic processes are less spreading and the neck is much longer. Male not found.

*Female* (Plate VII. fig. 1).—Length of head 2 millim., of neck 4 centim.; body 15 millim., abdomen 13 millim.

Head triangular, with blunted end, terminating posteriorly on the under surface in three short horns, the lateral being slightly divergent, all sharply pointed. At the blunted extremity in young specimens two pair of antennæ are visible, the anterior indistinctly three-jointed, provided with fine hairs at the extremity. *Posterior antennæ* with two short thick joints, the second bearing a strong thick recurved hook, which opposes a tubercle of the outer side of the same. Mouth-opening circular, near extremity on the underside, border ciliated. There are four pair of limbs placed a short distance posterior to the mouth; they are very small: the first and second limbs are two-branched, each having two joints, the last fringed with plumose hairs; the third and fourth limbs single-branched, three-jointed, the last carrying four plumose hairs. *Genital segment* elongated, flask-shape. Abdomen simple, straight, tapering slightly from the base, extremity blunt. Egg-sacs very long and fine, bright green when alive.

### Genus PERODERMA, Heller.

#### *Peroderma branchiata*, sp. n. (Pl. VII. fig. 2.)

A single example of this species was found on a small fish at Bombay—*Coilia Dussumieri*—the front two thirds being buried into the flesh above the pectoral fin, the posterior portion and egg-sacs only being visible; the bulbous anterior extremity was directed upwards, inwards, and forwards, the head at right angles above the ribs. This genus is described by Heller with a single species; it seems to be sufficiently distinct to be retained. (Pl. VII. fig. 2.)

*Female*.—9.5 millim. long without the egg-sacs. Body cylindrical, with a slight curve backwards at the posterior extremity. Anterior portion in front of neck rounded, one fourth of total length; neck narrow, cylindrical, longer than broad, placed at right angles to the body, bearing a thickened lobed head, furnished with a great number of fringed processes; these on higher magnification show the terminal branches to have a very regular manner of division, a bifid



end with a third longer side branch. Egg-sacs three or more times as long as the body. The arrangement of mouth-organs &c. was not made out, as I did not wish to sacrifice the specimen.

Length 9 millim.

### Family Chondracanthina.

#### Genus CHONDRACANTHUS, La Roche.

*Chondracanthus elongatus*, sp. n. (Pl. VI. figs. 4-6.)

Several specimens of this species were obtained from the gills of a sole (sp. ?) at Bombay. Most were mature females, and on some of these pigmy males were found attached singly near the genital pore (Pl. VI. fig. 4).

*Female*.—Length 6 millim. Head oblong, with greatly indented sides; median groove dorsally well marked; it equals one seventh total length. From the front border arise two long, simple, soft antennæ, as long as the head. *Posterior antennæ* placed immediately behind them in the form of two long slender hooks. Mouth-organs, as in others of this genus, placed near the neck. Thorax giving rise to two pair of slender processes, bifurcating at the ends. *Genital segment* elongated, cylindrical, with posteriorly two simple elongate processes, rather more than one third length of that segment. Abdomen short, rounded. Caudal plates simple, one third length of posterior appendages.

This species resembles somewhat *C. alatus*, Heller, found by him on a "*Gadus*," which species I have also taken here from gills of *Psettodes Erupei*.

*Male* (Pl. VI. fig. 6).—Very small, pyriform. *Posterior antennæ* placed at the anterior extremity in the form of short recurved hooks. *First maxilliped* with thick basal joint and well-marked prehensile simple claws. *Second maxilliped* more attenuated, with a simple straight spine. Body indistinctly segmented; two narrow, terminal, lanceolate caudal processes.

### Family Lernæopodidæ.

#### Genus BRACHIELLA, Cuv.

*Brachiella appendiculosa*, sp. n. (Pl. VI. figs. 1-3.)

Several specimens of this species were taken from the gills of fish in Bombay Harbour, viz. *Stromateus niger* and *Poly-nemus tetradactylus*. Its characters were well-marked and

both sexes were found, the pigmy male being single, attached usually to the genital segment under the arms of attachment (Pl. VI. fig. 1).

*Female*.—Cephalothorax in the same straight line as the body, rounded anteriorly, somewhat dilated. *Second maxillipeds* equalling in length the cephalothorax, directed downwards and forwards, widely separated from base to extremity, where they unite and give rise to a well-marked stalked disk of attachment; on the under surface of each arm is a process giving off four elegant elongated filaments. Body (genital segment) oval, constricted in front; from the posterior extremity on either side is a prolonged bifid appendage; centrally two small caudal lanceolate plates are present.

Length 6 millim.

*Male* (Pl. VI. fig. 3).—About 1 millim. long. *Cephalothorax* distinct from the body, which is long and indistinctly segmented, terminating in two short caudal processes. Anterior portion of the cephalothorax carrying the mouth-organs and antennæ. *Anterior antennæ* three-jointed, with three fine bristles at the end of the last joint. *Posterior antennæ* terminating in a thickened joint with a short tubercle on outer side, and the inner with a small recurved hook. *Mandible* long, with bifid end; extremity of mouth finely ciliated. Both pair of maxillipeds large; the first provided with a very strong hook, the second with a much smaller one.

I have not either the plate or description of "Steenstrup and Lütken" to refer to with regard to their *B. appendiculata*, and have therefore provisionally called this species as above.

## EXPLANATION OF THE PLATES.

### PLATE I.

*Fig. 1. Bomolochus tricerus*, ♀, sp. n., from back, magnified.

1 *a.* From underside, more enlarged. 1 *b.* Hamulus. 1 *c.* Posterior antennæ. 1 *d.* First peræopod. 1 *e, f, g.* Third, fourth, and fifth peræopods.

*Fig. 2. Bomolochus tetradonis*, sp. n., ♀, from back, enlarged.

2 *a.* Antennæ with mouth-organs, seen from beneath, much enlarged. 2 *b.* Terminal joint of posterior antennæ. 2 *c.* Extremity of second maxilliped. 2 *d, e, f, g.* Second, third, fourth, and fifth peræopods. 2 *h.* Caudal plate.

### PLATE II.

*Fig. 1. Caligus parvus*, ♀, sp. n., enlarged.

1 *a.* Under surface of cephalothorax. 1 *b.* Last joint of first peræopod. 1 *c, d.* Second and third peræopods. 1 *e.* Caudal plate.

Fig. 2. Male of same.

2 a. Anterior portion of cephalothorax. 2 b. Hamulus. 2 c. Posterior antennæ. 2 d. Last joint of first maxilliped. 2 f. Second maxilliped.

Fig. 3. *Caligus cybii*, ♀, sp. n., enlarged.

3 a. Anterior portion of cephalothorax. 3 b. Furcula. 3 c. First pereopod. 3 d, e, f. Second, third, and fourth pereopods. 3 h. Caudal plate.

#### PLATE III.

Fig. 1. *Caligus hirsutus*, ♀, enlarged.

1 a. Anterior portion of cephalothorax. 1 b. Furcula. 1 c. Last joint of fourth pereopod, highly magnified. 1 d. Caudal plate.

Fig. 2. Male of same, enlarged.

Fig. 3. *Caligus Phipsoni*, ♀, sp. n., enlarged.

3 a. Anterior portion of cephalothorax. 3 b. Caudal plate. 3 c. Second maxilliped. 3 d. Fourth pereopod. 3 e. Furcula.

Fig. 4. Male of same.

#### PLATE IV.

Fig. 1. *Caligus longicaudus*, ♀, sp. n., enlarged.

1 a. Cephalothorax from beneath. 1 b. Furcula. 1 c. Fourth pereopod. 1 d. Angle of genital segment and fifth pereopod. 1 e. Caudal plate. 1 f. Third pereopod.

Fig. 2. Male of same.

2 b. Second antennæ. 2 c. Second maxilliped.

Fig. 3. *Caligus (Sciænophilus) Benedeni*, ♀.

3 a. Cephalothorax from below. 3 b. Fourth pereopod. 3 c. Caudal plates. 3 d. Second maxilliped.

#### PLATE V.

Fig. 1. *Helleria armata*, ♀, gen. et sp. n.

1 a. Cephalothorax from beneath, much enlarged. 1 b. Seen from the side. 1 c. Margin of second maxilliped. 1 d. Mouth-organs. 1 e, f, g. First, second, and third pereopods. 1 h. Anterior antennæ, much enlarged.

Fig. 2. Male of same.

2 a. Cephalothorax from beneath, much magnified. 2 b. Caudal extremity. 2 c. Caudal appendage. 2 d. Second antennæ, terminal joint. 2 f. Lower lip and one of the styles.

#### PLATE VI.

Fig. 1. *Brachiella appendiculosa*, ♀, much enlarged, seen from side.

1 a. Organ of adhesion.

Fig. 2. Ditto, seen from underneath.

Fig. 3. Male of same.

3 a. Mouth-organs. 3 b. Antennæ. 3 c, d. First and second maxillipeds.

Fig. 4. *Chondracanthus elongatus*, ♀, much enlarged, from underneath.

Fig. 5. Ditto, seen from side.

Fig. 6. Male of same, highly magnified.

6 a, b. First and second maxillipeds.

PLATE VII.

- Fig. 1. *Lernæonema polynemi*, ♀, enlarged.  
 1 a. Cephalothorax in young specimen, showing antennæ &c.  
 1 b. Second peræopod. 1 c. Fourth peræopod. 1 d. Posterior antennæ.  
 Fig. 2. *Perodermia branchiata*, ♀, sp. n., enlarged.  
 2 a. Tentacular processes, much enlarged.  
 Fig. 3. *Lernanthropus trifolius*, ♀, sp. n., from underneath.  
 3 a. Seen from the side. 3 b. Under view of head from beneath.  
 3 c. Seen from the back. 3 d. Anterior antennæ, much magnified.

N.B.—Fourth peræopod on right side of *B. tricerus* in Plate I. fig. 1 a is drawn much too large.

II.—On the Respiration of *Carcinus mænas*, Leach \*.

By GEORGES BOHN †.

THE common shore-crab (*Carcinus mænas*), which is so abundant on our coasts, especially on the shores of Normandy, where it is called the *furious crab* (“*Crabes enragés*”), and where I have just been observing it daily for more than a month, exists, as all are aware, under very varied conditions. Some individuals bury themselves more or less in the mud; at low tide they are to be found hidden under stones or sunk in the sand; on the beach they run with rapidity, living as much in the air as in the water; in laboratories they are kept alive for very long periods in crystallizing-pans: I have seen some which have lasted more than a month in water which was not changed, surrounded by dead animals and rotten seaweeds.

While investigating the influence of the habitat upon the respiration of this crab, I have been led to observe a curious phenomenon, which, so far as I am aware, has not hitherto been described by anyone. I refer to the faculty of reversing for a longer or shorter period the direction of the circulation of the water in the branchial chamber.

Since the memorable observations of Audouin and Milne-Edwards upon *Maia* and the “great” crabs of our shores everyone has always followed these authors in stating that the water enters by a particular point situated in front of the anterior legs, and traverses the branchial chamber from

\* A study carried out at the marine laboratory of the Muséum at Saint-Vaast-la-Hougue.

† From the ‘Comptes Rendus,’ t. cxxv. no. 11 (September 13, 1897), pp. 441-444.

































